

WHAT IS CLAIMED IS;

1. A water-repellent film-coated article comprising
a substrate and
a water-repellent film, composed of silicon oxide and at
least one of metal oxide selected from the group consisting
of magnesium oxide, calcium oxide, strontium oxide and boron
oxide and having a water-repellent group, coated on the surface
of the substrate.

2. A water-repellent film-coated article according to
claim 1, wherein said water-repellent film contains
silicon oxide at 70-99 mole percent (based on SiO_2),
at least one of metal oxide selected from the group
consisting of magnesium oxide, calcium oxide, strontium oxide
and boron oxide at a total of 1-30 mole percent (based on MgO ,
 CaO , SrO and $\text{BO}_{3/2}$), and
a water-repellent group at 0.01-20 wt%.

3. A water-repellent film-coated article according to
claim 2, wherein said water-repellent film further contains,
in terms of mole percent, at least one of metal oxide selected
from the group consisting of zirconium oxide, aluminum oxide,
gallium oxide, indium oxide, scandium oxide, yttrium oxide,
lanthanum oxide, cerium oxide, cobalt oxide, iron oxide, nickel

oxide, copper oxide and zinc oxide at 0.5-5%, based on ZrO_2 , $\text{AlO}_{3/2}$, $\text{GaO}_{3/2}$, $\text{InO}_{3/2}$, $\text{ScO}_{3/2}$, $\text{YO}_{3/2}$, $\text{LaO}_{3/2}$, $\text{CeO}_{3/2}$, CoO , $\text{FeO}_{3/2}$, NiO_2 , CuO and ZnO .

4. A water-repellent film-coated article according to
5 claim 1, wherein said water-repellent film contains

silicon oxide at 70-98 mole percent (based on SiO_2),

magnesium oxide and/or calcium oxide at 1-29 mole percent
(based on MgO and CaO),

boron oxide and/or zirconium oxide at 1-29 mole percent
10 (based on $\text{BO}_{3/2}$ and ZrO_2) and

a water-repellent group at 0.01-20 wt%.

5. A water-repellent film-coated article according to
claim 4, wherein said water-repellent film further contains,
in terms of mole percent, at least one of metal oxide selected
15 from the group consisting of aluminum oxide, gallium oxide,
indium oxide, scandium oxide, yttrium oxide, lanthanum oxide,
cerium oxide, cobalt oxide, iron oxide, nickel oxide, copper
oxide and zinc oxide at 0.5-5%, based on $\text{AlO}_{3/2}$, $\text{GaO}_{3/2}$, $\text{InO}_{3/2}$,
 $\text{ScO}_{3/2}$, $\text{YO}_{3/2}$, $\text{LaO}_{3/2}$, $\text{CeO}_{3/2}$, CoO , $\text{FeO}_{3/2}$, NiO_2 , CuO and ZnO .

20 6. A water-repellent film-coated article according to
any one of claims 1 to 5, wherein said water-repellent group
is an alkyl group or fluoroalkyl group.

7. A water-repellent film-coating composition

containing

- (A) a thoroughly hydrolyzable silane compound,
- (B) a silane compound with a water-repellent group,
- (C) an acid and

5 (D) a compound of at least one of metal selected from
the group consisting of magnesium, calcium, strontium and
boron.

8. A water-repellent film-coating composition according
to claim 7 which contains said silane compound (A) at 0.01-2
10 wt% based on SiO_2 , said silane compound (B) at 0.00001-0.15
wt% based on SiO_2 , said acid at 0.001-3 N, water at 0-5 wt%
and said compound (D) at a molar ratio of 0.01-0.4, based on
MgO, CaO, SrO and $\text{BO}_{3/2}$, with respect to said silane compound
(A).

15 9. A water-repellent film-coating composition according
to claim 7 or 8 which contains an alcohol as a solvent.

10. A water-repellent film-coating composition
containing

- (A) a thoroughly hydrolyzable silane compound or its
20 hydrolysate at 0.01-2 wt% (based on SiO_2),
- (B) a silane compound with a water-repellent group at
0.00001-0.15 wt% (based on SiO_2),
- (C) an acid at 0.001-3 N,

(D-1) a magnesium and/or calcium compound at a molar ratio of 0.01-0.4, based on MgO and CaO, with respect to said silane compound (A) (based on SiO₂),

(D-2) a boron and/or zirconium compound at a molar ratio
5 of 0.01-0.4, based on BO_{3/2} and ZrO₂, with respect to said silane compound (A) (based on SiO₂),

(E) a compound of at least one of metal selected from the group consisting of cobalt, iron, nickel, copper, aluminum, gallium, indium, scandium, yttrium, lanthanum, cerium and zinc
10 at a molar ratio of 0-0.4, based on CoO, FeO_{3/2}, NiO₂, CuO, AlO_{3/2}, GaO_{3/2}, InO_{3/2}, ScO_{3/2}, YO_{3/2}, LaO_{3/2}, CeO_{3/2} and ZnO, with respect to said silane compound (A) (based on SiO₂), and

(F) water at 0-20 wt%.

11. A water-repellent film-coating composition
15 according to claim 10 which contains an alcohol as the solvent.

12. A water-repellent film-coating composition according to any one of claims 7 to 11, wherein said silane compound (A) is a tetraalkoxysilane or tetrachlorosilane.

13. A water-repellent film-coating composition
20 according to any one of claims 7 to 12, wherein said acid is hydrochloric acid, nitric acid, acetic acid, formic acid or trifluoroacetic acid.

14. A process for preparation of a water-repellent

film-coated article, characterized by applying a water-repellent film-coating composition according to any one of claims 7 to 13 onto a substrate surface and drying it.

15. A process for preparation of a water-repellent
5 film-coated article according to claim 14, wherein said drying is carried out at room temperature.

16. A process for preparation of a water-repellent film-coated article according to claim 14 or 15, wherein said drying is carried out in an atmosphere at 40% relative humidity
10 or lower.

17. A process for preparation of a water-repellent film-coated article according to any one of claims 14 to 16, wherein said drying is followed by heating at a temperature of from room temperature up to 300°C.

15 18. A process for preparation of a water-repellent film-coated article according to any one of claims 14 to 16, wherein said drying is followed by heating at a temperature of from room temperature up to 150°C.

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